DOCUMENT RESUME

ED 205 674 CE 028 743

AUTHOR Hult, Marit
TITLE Technological Change and Women Workers: The Development of Microelectronics. World Conference of the United Nations Decade for Women: Equality, Development, and Peace. Report Number 80-14948.
INSTITUTION United Nations General Assembly, New York, N.Y.
PUB DATE 80
NOTE 39p.; Paper presented at the World Conference of the United Nations Decade for Women: Equality, Development and Peace (Copenhagen, Denmark, July 14-30, 1980).

EDRS PRICE MF01/PC02 Plus Postage.
DESCRIPTORS Developed Nations; *Electronics; Employed Women; Employment; *Employment Opportunities; Employment Projections; *Females; Futures (of Society); Labor Market; Service Occupations; *Technological Advancement; *Work Environment
IDENTIFIERS *Microelectronics

ABSTRACT

This report reviews the current debate in industrialized market economy countries on the impact of microelectronics technology on employment. A special focus is on the impact on women's employment opportunities. Chapter 1 presents information on the technological background, including the development of microelectronics and their application in the service sector. Chapter 2 reviews three views in the debate on microelectronics and employment: optimistic, pessimistic, and moderate. In chapter 3 the possible impact of microelectronics on various industries and occupations is discussed. Some quantitative estimates are given. Chapters 4 and 5 concern the impact on women's employment opportunities and working conditions. Issues include the disproportionate effect on the female labor market, possibilities opened by technological change, positive effect on work environments, fragmentation of work, and reduction of skill requirements. Chapter 6 suggests these courses of action: (1) women's participation in public debate and decision making, (2) women's participation in trade union debate and decision making, and (3) compensatory educational and labor market policy measures. (YLB)

****
* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *
****

ED205674

A/CONF.94/26

CE

WORLD CONFERENCE

of the

UNITED NATIONS DECADE FOR WOMEN:

Equality, Development and Peace

U.S. DEPARTMENT OF HEALTH, EDUCATION & WELFARE
NATIONAL INSTITUTE OF EDUCATION

THIS DOCUMENT HAS BEEN REPRODUCED EXACTLY AS RECEIVED FROM THE PERSON OR ORGANIZATION ORIGINATING IT. POINTS OF VIEW OR OPINIONS STATED DO NOT NECESSARILY REPRESENT OFFICIAL NATIONAL INSTITUTE OF EDUCATION POSITION OR POLICY

"PERMISSION TO REPRODUCE THIS MATERIAL HAS BEEN GRANTED BY

Lucille M. Mair

TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)."

Copenhagen, Denmark

14-30 July 1980

CE 028 743

TECHNOLOGICAL CHANGE AND WOMEN WORKERS: THE DEVELOPMENT OF MICROELECTRONICS

Item 8 (a) of the provisional agenda

80-14948

/...

TECHNOLOGICAL CHANGE AND WOMEN WORKERS: THE DEVELOPMENT OF MICROELECTRONICS

by Marit Hult

Consultant*

SUMMARY

The present report reviews the current debate in industrialized market economy countries on the impact of microelectronics technology on employment, with a special view to the impact on women's employment opportunities.

Arguing that there are reasons to believe that women as a group will be disproportionately affected by future technological change, the report underlines that Governments and other decision-making bodies are responsible for establishing a policy to prevent such an adverse effect on women.

The report also urges women to participate in the ongoing debate and decision-making process on technology and thus make their influence felt.

---

* The views expressed are those of the author and do not necessarily reflect those of the United Nations Secretariat.

/...

INTRODUCTION

1. The last few years have witnessed a growing debate in developed countries on the impact of microelectronic technology. The "new" technology, as it is often called, has the potential of deeply affecting future society in terms of the organization of work and leisure, distribution of wealth and management of information systems. The debate has been particularly strong with respect to its impact on employment. Our concern in this paper is with the effects of microelectronics on women's employment opportunities and working conditions.

2. The field of microelectronics includes such devices and automation procedures as computers, word processors, integration of data processing in telecommunications and industrial robots.

3. The employment consequences of microelectronics on women have not been previously discussed in the international arena. However, a growing concern and a need for research and discussion have been expressed among women throughout the world. The seminar on the participation of women in the economic evolution of the region of the Economic Commission for Europe (ECE) made the following recommendation to the preparatory committee for the World Conference of the United Nations Decade for Women: 1/

> "Effects of economic and technological development on the educational, training and employment opportunities for women as well as on their working conditions, should be duly taken into consideration when identifying future policies".

4. This report presents background documentation in response to the seminar's recommendation.

5. In the general debate on microelectronics and employment, two extreme views have emerged. According to the "optimistic" view, technological change, by raising productivity and reducing unit costs, will create opportunities for economic growth and, therefore, employment. Countering this, the "pessimistic" view maintains that, particularly in a stagnating economy, new technology will mean unprecedented unemployment levels as a result of major job loss without a sufficient number of new jobs created. A more "moderate" view stresses that while the resulting job balance for the economy may be unknown, structural changes and adaptational problems will almost certainly develop.

6. The present report reviews these arguments partly because it is a necessary starting point for understanding the impact on women's employment opportunities and partly because we believe women should be familiar with the debate in order to express their viewpoints (chap. 2).

1/ Submitted to the World Conference of the United Nations Decade for Women Report on the seminar on Participation of Women in the Economic Evolution of the ECE Region (A/CONF.94/14).

/...

7. For the same reasons we have included a chapter on technological background (chap. 1).

8. An analysis of aggregate employment levels, however, tends to conceal adjustment problems involved in such change. A review of the possible impact of microelectronics on various industries and occupations is, therefore, a necessary further step in order to assess the consequences for women (chap. 3).

9. Our main question is whether women as a group are disproportionately concentrated in industries and occupations most likely to be affected by microelectronics. If this is so, women are also disproportionately exposed to the employment difficulties associated with technological change. Our analysis tends to support such a contention. Women have reasons for concern about employment opportunities (chap. 4) and working conditions (chap. 5).

10. The report suggests certain courses of action which may help solve some of the adjustment problems and enable women to benefit from opportunities inherent in the new technology. Women are strongly urged to join the debate on technological change and make their influence felt (chap. 6).

11. Microelectronics have important implications for women also in developing countries. A separate paper prepared for the United Nations Industrial Development Organization (UNIDO) analyses the impact already felt by women workers in Latin America and South-East Asia, where multinational corporations in the electonics field have based the assembly of microchips and some consumer goods on cheap female labour.

12. Automation due to microelectronics tends to balance out the low wages of developing countries as a factor in international competition. For example, some of the textile industry, which initially moved to developing countries to use cheap labour, has now returned to the developed countries because of automated processes. The assembly of microelectronic components may follow this pattern - with a subsequent loss of employment opportunities in the developing world. Furthermore, a possible future application of microelectronics technology in the developing countries themselves makes the complex problems they face in their choice of appropriate technologies, even more serious.

13. Material has not been available to cover these aspects of the impact of microelectronics on employment opportunities in developing countries. Nor was it possible to incorporate the industrialized centrally planned economy countries into this paper. The report then analyses development trends in industrialized market economy countries.

/...

I. Technological background 2/

A. The development of microelectronics

14. Microelectronics comes under the broader umbrella of semiconductor technology. Semiconductor technology is used to manufacture integrated circuits (IC), which contain many interconnected transistors placed on small semiconductor "chips" of silicon each only a few millimetres square. Integrated circuits are referred to collectively as "microcircuits", and the technology which involves their use is referred to as "microelectronics".

15. One of the most significant features of microelectronic technology is that it enhances computer technology. In 1971, integrated circuits were first used to form microprocessors - the miniaturized version of a large computer's central processing unit, sometimes referred to popularly as its "brain" - all contained on a single chip of silicon the size of a thumbnail.

16. Combined with appropriate input-output devices (printer, keyboard, video displays) and memory, the microprocessor becomes a micro computer. For computers, the development of the microprocessor has meant reductions in size, cost and power consumption and increases in speed and the size of the problem that can be tackled. Today, a small hand-held calculator, which can be bought for less than $500 in the United States, has more computational power than the first computer built in 1946 (ENIAC) which filled an entire room and cost several million dollars.

17. The reduction in cost and size, combined with increased performance and reliability, make the application of microprocessors feasible in a whole series of uses beyond those associated with "traditional" computerization. The microprocessor is the current high point of microelectronics. In conjunction with the equally impressive quantum leaps being made in satellite and telecommunications technology, it can be considered as the core of "the new technology".

18. It must be kept in mind, however, that the actual microprocessors (the chips), which can cost as little as $1. to $10., are the least expensive parts of any product or system incorporating microelectronics.

19. While the cost of producing hardware (the machinery) has been drastically reduced, the cost of producing software for an application has risen perhaps

---

2/ This chapter is, to a large extent, based on information found in: The Impact of Microelectronics on Employment in Western Europe in the 1980's (Brussels, European Trade Union Institute, October 1979). FIET (International Federation of Commerical, Clerical and Technical Employees) Conference on Computers and Work, Velm, Austria, 17-18 November 1978. Employment and Technology, a TUC Interim Report, London, 1979. The Manpower Implications of Microelectronic Technology, a report by Sleigh, Boatwright, Irwin and Stanyon, a Department of Employment study group, London 1979.

/...

tenfold in the 1970s. 3/ A software programme is the sequence of instructions which are executed by the hardware. Some large software systems contain hundreds of thousands, even millions of instructions and can take an equivalent number of man days to complete. Software is a labour-intensive business which is why it is an increasing proportion of the total cost of computer systems.

B. The application of microelectronics - examples

20. Microelectronics are applied both in products and processes. Our examples will be drawn from the service sector while the application in products and in manufacturing processes only, will be referred to.

21. In products, microelectronics may be used to develop new microprocessor-based products (electronic toys, television games); it may be incorporated in old products and thus change their functions and/or reduce the cost of production (pocket calculators, sewing machines, office equipment), or it may be used to add new functions to old products (data processing equipment, scales with price calculators).

22. In manufacturing processes, the technology is applied in numerically controlled (NC) and computer numerically controlled (CNC) tools, in robots and in computer aided design (CAD), just to mention some examples.

23. In the service industries, the microelectronic technology will first and foremost affect the whole range of functions known under the general heading "information processing".

1. Offices

24. Offices have, until now, computerized series of functions within an organization by setting up a central electronic data-processing department to manage the computerized system. Cost accounting, auditing, communications, general administration, purchasing and sales, operations research and planning, resource administration, finance, inventories, payroll and personnel are examples of functions computerized. It is estimated that microprocessors may lead away from this general approach and encourage the purchase of microcomputers on a piecemeal basis designed for specific tasks.

25. The development of "word-processing" machinery is supposed to have the most significant effect on office work. The typical word-processing machine consists of an expanded typewriter keyboard, with a visual display unit and a printer attached. Information typed into the machine is displayed visually, and the contents of the screen are stored in the machine's "memory". This information can then be manipulated or processed by means of the keyboard before printing or storing on a disk for subsequent printing. This reduces the need for retyping and eliminates routine work before being printed.

3/ The Economist, 1 March 1980.

/...

26. The word processor also enables direct access to and selection and sorting of the information stored, thus making redundant many tasks currently performed by filing, library and secretarial staff.

27. A further stage in the automation of office work is the integration of word-processing machinery into a telecommunications network. Information can be transmitted directly from one office to another and stored. It is already feasible to integrate word processors with telex machines, and with the further development of cable network and "view data" systems, the process can go further. It is also common to integrate word-processing equipment with photocomposition to produce high-quality publications without typesetting.

2. Banking and insurance

28. The banking sector has been at the forefront of computerization in the last decade. The first stage was the creation of central records of customer accounts on a computerized basis with terminals located in bank branches. The second main area has been in the field of interbank transfers where data transmission between computer centres is taking over from postal communications. A third stage is the introduction of customer-operated bank terminals or "cash dispensers". These use electromagnetic techniques to identify the customers and to carry out transactions. A further stage of automation will take place if electronic funds transfer (EFT) systems are introduced. Cash will then be ultimately dispensed with and the credit will take place at the point of sale, with the funds being transferred from buyer to seller electronically.

29. Computerization in the insurance sector has followed a pattern similar to that of banks.

3. Commercial sector

30. One of the most significant forms of computerization has been linking automatic stock control to electronic cash registers. The sales recorded on cash registers in a retail outlet can be automatically relayed to a computer in a central warehouse, which calculates the stock replenishment requirements and issues orders for goods to be dispatched to outlets when their stock levels fall to a minimum.

Further technological developments have taken place in the price labelling and recording of stock, where bar codes on an item now can identify it, and its price is retrieved from a central computerized record. The need for staff to record stocks or change prices will consequently be reduced.

4. Telecommunications

31. The first area of application is the process of message switching which already has been automated. In most industrialized countries, the technology used to date is electromechanical. It is now clear, however, that the 1980s will see an

/...

accelerated introduction of electronic or semi-electronic exchanges. At the same time, there will be an increase in the introduction of optical fibres to replace existing copper cables. The use of satellite communication for switching information will also increase.

32. The improved capacity in telecommunications will accelerate the convergence of computing or data processing and the telecommunications system - a development often called "telematics". Experiments have already begun with new types of telematics service in some countries, based upon the linking of the telephone system with television sets to provide an "interactive" information system.

5. Postal services

33. Microelectronics may be expected to have an impact on the postal business through electronic mail in addition to mechanization of mail handling and computerization in the administrative/clerical areas. The term, "electronic mail", covers letters or other documents transmitted by electronic means. The application is likely to take place first in the intracompany market, move on to intercompany mail and, in the long term, possibly to residential or personal mail.

34. The examples given in this chapter should give some idea of the potential range of microelectronics. How fast the technologically feasible actually will be implemented remains to be seen. Experts, although still considering the 1980s as a golden age of electronics, seem to believe that the spread of microchips will be slower than many forecasts earlier have suggested. One of the reasons is that the chips themselves are in short supply and probably will be so for another five years. Besides, it takes time to design new products based on them and time to retrain people in some of the difficult skills needed to apply them. Above all, it will require money to finance a massive investment in new plants and machinery. 4/

II. Impact on employment - over-all level

35. As mentioned above, the public debate on the employment consequences of microelectronics has grown quite intense during the last few years, and a more or less polarized view has emerged.

36. One group refers to present technological advances as "the microelectronic revolution" causing fundamental changes in the organization of work. Their employment forecasts are very pessimistic ones of large-scale unemployment, and they claim that by the end of the century there will be jobs for only a minority of those in the age groups constituting the would-be working population.

37. Another, more optimistic group, points out that there is nothing new in technological change, nor is the debate on "technological unemployment" unprecedented in history. Mechanization and automation have been with us since the "Spinning Jenny" and the steam engine led the way for the Industrial Revolution some 200 years

---

4/ The Economist, 1 March 1980.

/...

ago. Development in data processing and telecommunications is nothing but part of a continuous process of technological change. Automation has always created more jobs than it has displaced. The displaced labour force has been used for other purposes in such a way that society's total output and income have increased.

A. The optimistic view

38. The latter view characterizes much of the debate of the United States, where the dominant view seems to be that technology in general has been a boon to the American public and to the American worker. American experience over the last three decades is said to indicate that as long as the economy is expanding and demand is increasing, steady technological advance is compatible with rising employment. The United States Bureau of Labor Statistics projections do not suggest that technological change will represent a serious problem in the years ahead. If anything, the changes projected for the next 10 years are supposed to be more gradual and less disruptive than similar changes that have taken place over the last 30 years. The disturbing elements foreseen in the future are linked to limited productivity gains, difficulty with energy supplies and continuing inflation, not with technological change. 5/

Another prevailing view claims that there is no choice but to adopt new technologies. Otherwise, industry will lose its competitiveness. If some jobs are not sacrificed to automation, entire sectors risk becoming internationally uncompetitive, with resulting job loss to a much larger number of people.

39. A positive attitude about computer technology is also expressed, among others, by the Nordic trade union movement. Technological development is seen as having provided a basis for a rising material standard, making it possible for trade unions to carry through demands for wage increases.

40. Adverse effects and adjustment problems are warned against, however, and it is stressed that the necessary structural change must take place in socially acceptable forms and with a significant social and trade union influence on how the structural change is realized. "Correctly applied computer technology can offer great possibilities for employees and their trade union organizations, but a condition for the use of computers in working life as a tool in the service of democracy and not as an instrument to consolidate the existing positions of power, is that the trade union organizations have a deciding role in the formation of data systems and in the application of data technology". 6/

5/ Dr. Jerome A. Mark, Assistant Commissioner, United States Bureau of Labor Statistics, "Measuring the effects of technological change" in Silicon Satellites and Robots.

6/ Council of Nordic Trade Unions, Guiding Lines for Nordic Trade Union Work With Computing Issues (Stockholm, September 1979).

/...

41. The optimistic view in its purest form is expressed in the following: 7/

> "The new knowledge will be (and has been) creating new technologies which increase levels of productivity (wealth creation) to undreamed of heights. 250 years ago 95% of the labour force worked on farms to support the other 5%. Today in the US less than 4% of the labour force works on farms. It supports not only the other 96%, it feeds much of the rest of humanity as well. The same process which occurred in agriculture, i.e., which has happened to the primary sector of the economy, is happening today in the secondary sector of technologically advanced economies. The next generation may find it needs no more than 10% of its labour force to provide it with all the material goods needed. The primary activity then will become education, health and social care. The new productivity would provide society with the wealth needed to sustain these other sectors of society."

42. It is added, though, that an active government policy is needed to ensure such an outcome and prevent large-scale unemployment. A systematic reduction in work time on a transnational level, a significant effort at retraining workers at risk and, above all, a massive expansion of service sector jobs are suggested as necessary measures. 8/

B. The pessimistic view

43. Groups, warning against the dangers inherent in technological change, point out that the development process has not been without problems for large groups of the population. Emphasizing that the Industrial Revolution created a new class of capitalists and made trade flourish, they point to the human suffering with which industrial developments were achieved.

44. The pessimists in the technology debate predict a major job loss as a result of applying new technology, foreseeing catastrophic effects on aggregate employment. Arguing that the production of microelectronic components as well as the application of new technology open up very few new jobs; that the service sector, which hitherto has absorbed displaced workers from manufacturing industries and newcomers, now is about to be automated as well, they stress that the economy will not be able to offer enough job opportunities for those seeking work.

45. Furthermore, they point out that the simple balance between jobs created and jobs lost is not the only issue. There is also the question of how easy it is to transfer workers from the declining to the growing areas, bearing in mind barriers of skill, of geography, of pay, etc.

7/ Professor Tom Stonier, "Education and the post industrial society", paper delivered at Manchester Polytechnic.

8/ Tom Stonier, "The third Industrial Revolution, microprocessors and robots", in Effects of Modern Technology on Workers, discussion papers IMF, Central Committee 18-19 October 1979, Vienna.

/...

46. They also stress that, although the use of microprocessors will create some new high-level jobs, the effects on relatively routine work is to remove any skill element from it altogether. The result could be a polarization of the work force into a technological elite who has access to a fascinatingly rich work environment requiring flexibility, adaptation and intellectual creation and a much larger deskilled proletariat with the prospect of increasingly alienating physical work or none at all. 9/

C. The moderate view

47. Although the two extreme views may have dominated public debate, particularly the media, until now, there seems to be a growing number of articles, reports and books that take a view in between, stressing the uncertainty of the situation, the conflicting tendencies found and, in fact, the lack of actual knowledge.

48. They give the following reasons for considering microelectronics differently from earlier technological changes posing new problems and challenges which are not easily coped with on the basis of earlier experiences: 10/

(a) The rate of diffusion of microelectronics has the shortest known take-over time. While for traditional technologies, these have been measured in decades; for microelectronics the take-over time is measured in years.

(b) Microelectronics is a technology that permeates practically all sectors of the economy. Nearly everywhere that information has been processed, either manually or mechanically, the chip could have an impact. It replaces not only mechanical processes, but decision-making processes as well - not only muscles but also the human brain. Moreover, this process takes place simultaneously in almost all occupations and sectors of society.

(c) The price/performance relation for microelectronic components and computers is rapidly decreasing. Society has no previous experience with such a continuous price reduction of an important input factor in the economy. The need to invest in new technology will, therefore, be felt within a short space of time, especially in internationally competitive branches.

(d) Employment in the computer industry itself, although it grew rapidly the 1950s and 1960s, is not actually very big. Furthermore, results of an industrial interview programme of the Organisation for Economic Co-operation and Development (OECD) show that the leading multinational electronic firms within the United States, Japan and the European Economic Community (EEC) do not expect to increase their employment over the next few years, although they do expect an enormous increase in production, especially in the microprocessors and capital goods, but also in consumer goods.

9/ Among others, Professor Ron Johnston, Chairman, Department of History and Philosophy of Science, University of Wollongong, Australia.

10/ See among others: "The impact of computer/communications on employment in Canada: an overview of current OECD debates", Institute for Research on Public Policy, Z. P. Zeman, Project Leader, Montreal, November 1979; Anne Maus, Jostein Fialestad and Gunnar Myrvang, "EDB og sysselsetting" (Data Processing and Employment), Norwegian Computing Center, March 1979.

/...

(e) Because of high reliability of microelectronic components, the need for repair and maintenance work will be drastically reduced compared to mechanical and electromechanical components.

(f) The service sector which has historically absorbed displaced workers, is itself subject to the introduction of advanced technologies designed to reduce job positions. In fact, job loss is likely to be much greater in the service sector than in the manufacturing sector.

(g) The impact of technology on the level of employment should not be isolated from the general economic outlook for the 1980s. A major reason for great concern is that the impact of microelectronics is taking place at a time of already severe cyclical problems in the industrialized world and of both structural and demand deficient unemployment. This pattern is likely to persist into the 1980s unless economic policies are changed.

49. After having pointed out the reasons for concern, the moderates argue that authors of extremely pessimistic forecasts have usually fallen into one or several of the following traps:

(a) Assuming that because a change is technologically feasible, it will be developed and adopted. The critics stress that it is economic and social policies and political concerns that determine whether a technology will, in fact, be developed and widely purchased. 11/

(b) In connexion with the above argument, it is stressed that, although the production costs of chips have fallen dramatically, the design of software programmes and systems is expensive (see chap. 1). In some areas, mass-produced microprocessors, pre-programmed to carry out certain functions, may be used, thus keeping software costs down. They may, however, require costly changes in operations and organization of work. In other areas where custom-built or industry "specials" may have to be used, the microprocessors themselves will be expensive.

50. Even including software costs, the microprocessor may still only be a relatively small part of the cost of the total item in which it is incorporated. For instance, in a consumer pocket calculator, the processor and memory costs represent only some 20-35 per cent of the total cost. 12/ Thus, further decline in cost is unlikely unless there are similar technological breakthroughs in the other components.

(a) Another argument along the same line stresses that cultural, organizational and legal practices also impede the rapid diffusion of new technology. Office automation, for example, involves not only the purchase of a few machines, but a systematic reorganization of the work structure which is difficult or expensive to install. While trade union action against job displacement often is cited as a constraint on technological change, another constraint is found in managerial practices which often are "conservative" in their approach to change.

11/ See Ian Byron and Ray Curnow, The Future with Microelectronics: Forecasting the Effects of Information Technology (University of Queensland Press).

12/ The Impact of Microelectronics on Employment in Western Europe in the 1980s, op cit.

/...

(b) Another obstacle often mentioned is the shortage of specialized workers that would slow down any rapid introduction of the new technology. Neither now nor in the future will many industries have the skilled personnel for the fullest possible use of microelectronics.

(c) The most frequently cited short-coming is the technique used in many studies of extrapolating employment consequences from the experience of a few companies to an entire sector or even to the entire economy. The studies often involve assumptions of static demand for the goods and services in question and take no account of the development of whole new industries such as the "information industry". There are reports 13/ that indicate that the "information industry" will soon be the largest employer in the economy of the United States. This is largely caused by computerization.

51. It seems justified to sum up the discussion on general employment effects of microelectronics by observing that with the present state of knowledge and with so many factors at play, no one really knows what the net employment outcome of this new wave of technological change will be.

52. Whatever the impact on aggregate employment levels will be, however, adjustment problems will certainly occur during the process of change. Theoretically, microelectronics can have both job displacement and job creation effects with the net result being even, but there is no guarantee of such an outcome for the individual affected by the process. Ignoring or playing down the problems that arise from an unthinking acceptance of all forms of new technology is thus unacceptable and can only make the eventual solutions of adjustment problems more difficult.

13/ National Information Policy, report to the President of the United States, 1976.

/...

III. Impact on employment - sectors

53. Before considering whether women as a group will be adversely affected by microelectronics, it is necessary to gain a better picture of the potential changes in different sectors and occupations. A great many efforts have been made to establish accurate quantitative estimates of the employment impact in various sectors. Over-all quantification has, however, until now proved impossible, and most of the forecasts are bound to be highly subjective.

54. The effects of technological change on employment are very difficult to measure. They are indirect and diffuse since technological change does not take place in isolation. Technological changes interact with and are modified by many other factors that affect employment such as changes in output, demand, consumer tastes and international competition. Furthermore, the effects do not necessarily occur only at the plant which introduces the change but more often, through the mechanism of competition and industrial structure, in other plants and industries throughout the economy. In addition, as pointed out above, there are several fallacies associated with extrapolating from a few examples to entire sectors.

55. Nevertheless, we have chosen to give some of the quantitative estimates made, in order to give an idea of the extent of the problem and its relative importance in different sectors. Our examples are case studies, describing some major actual or potential technological developments and their likely employment trends.

A. The service sector - a field of potential automation

56. Our concern will be the service sector, partly because of its overwhelming importance for female employment, partly because there are reasons to believe that it will be the sector hardest hit by future technological change. Several factors support the latter view.

57. First, there is the simple fact of numerical importance. The number of people directly involved in the manufacturing process (that is, excluding foremen, supervisors, administrative staff and management, which, in fact, belong to service occupations) is relatively small - less than 20 per cent of the working population in most industrialized countries - so the effects of microelectronics in the manufacturing sector are unlikely to be very great in over-all terms. 14/ In fact, concern is expressed that the employment threat inherent in microelectronics is underestimated because most of the attention and effort to ease the impact of technological change is directed at the manufacturing sector. The industrial sector can look back on past experiences with automation, while the adjustment facing service workers is likely to be more abrupt and harsh. 15/

14/ Byron and Curnow, The Future with Microelectronics ..., op. cit.

15/ Thomas R. Donahue, Executive Assistant to the President, AFL-CIO "The challenge of technology" in Silicon, Satellites and Robots.

/...

58. Second, the productivity of the manufacturing workers has already been greatly increased. The investment of further capital in the form of electronic control systems can, therefore, only be expected to have a relatively marginal impact on their performance. The service sector, on the other hand, represents an enormous field of potential automation. While the productivity of blue collar workers has increased many times during the past two decades, office administration costs have continually risen with production levels remaining relatively constant.

59. In the words of a Xerox Company employee: "The American factory worker today is capitalized (or mechanized) to the tune of about $25,000 per worker, and he is the most productive worker in the world. The average secretary or clerk works with $500 to $1,000 worth of old typewriters and adding machines, and is probably among the least productive workers in the world. That's why we're after the secretary and other assorted support workers. The name of the game we're playing is productivity." 16/

60. Third, it was argued in chapter 2 above, that because microchips are cheap, it does not necessarily follow that the applications of them are. This holds for the manufacturing sector, but in the service sector there is, and will increasingly be, a much more direct relationship between the cheapness of chips and the cost of end applications. Continuing cost reduction and increasing standardization are likely to be two of the most profound influences behind the anticipated spread of office technology. 17/

61. Fourth, the fundamental effect automation in the service sector may have on over-all employment, is further underlined by the fact that there has been a tendency to look to the service sector to make good in numerical terms, the job opportunities that have disappeared from the manufacturing sector. Thus, even stabilization of employment within the service sector could result in accumulative increases in the unemployed. 18/ It must also be kept in mind that a great deal of employment in the manufacturing industry is, in fact, office employment and thus subject to the same automation.

B. Past experiences with automation

62. Although automation in the tertiary sector is lagging behind the manufacturing sector, application of electronic data processing has already been used for quite a few years. Some jobs have been lost in the data-processing field, some have been created and some have changed. The computer industry now employs some 200,000 people in the EEC countries and 800,000 are employed as computer users. A European Commission forecast is that by the mid-1980s, 400,000 will be employed directly and another 1.5 million in electronic data processing. 19/

16/ Quoted in Jon Stewart, "Computer shock, the inhuman office of the future", SR 6/23/79.

17/ Sleigh and others, The Manpower ..., op. cit.

18/ Ibid.

19/ Information in this and the following paragraph is mostly taken from The Impact of Microelectronics on Employment in Western Europe in the 1980's, op. cit.

63. However, the net employment effect of computerization is less clear. A study carried out by the Swedish National Bureau of Statistics estimated that in Sweden, between 1968 and 1977, computerization resulted in manpower saving in the economy as a whole equivalent to approximately 1 per cent of the total work force.

64. A British study 20/ claims that computers in the Civil Service may have restrained the growth of clerical employment, but not reduced it. In the period between 1970 and 1977, there was a growth from 170,000 to 200,000 staff in categories most likely to have been affected by computer installations. The introduction of new technologies, then, have suggested new areas of work and new services. In other cases, the staff, freed by computer applications, have been absorbed in new services, not directly computer related, but as an outgrowth of computerization.

65. Hence in the past, growth in demand for business services seems to have made up for any negative effects on employment in the tertiary sector.

C. Future prospects

66. In the future, microelectronics will result in the application of electronic data processing more broadly across the service sector, affecting a range of services not previously susceptible to automation.

67. A consideration of clerical employment can give an indication of the degree of displacement which may occur. If the same productivity increase which took place in the manufacturing sector in France, the Federal Republic of Germany and Italy between 1960 and 1973, were to happen in clerical employment in the period 1980-1993 in Western Europe as a whole, there would be roughly no growth at all in clerical employment over the period, compared with the fast growth in clerical employment in most of the post-war period. 21/

68. A faster rate of productivity growth can lead to significant labour displacement in clerical occupations. FIET 22/ has pointed out that at a rate of 8 per cent in the office sector over a 10-year period, 20-25 per cent of office staff would be displaced. Five million out of the 17-18 million clerical staff in Western Europe would then be out of work.

69. Siemens estimated in its report "Office 1990" that out of 2.7 million office jobs in the Federal Republic of Germany which were considered, 43 per cent could be standardized and 25-30 per cent automated. The French Nora report 23/ forecasts

---

20/ "Social and employment implications of microelectronics", paper by the Central Policy Review Staff, United Kingdom, November 1978.

21/ The Impact of Microelectronics on Employment in Western Europe in the 1980's, op. cit.

22/ FIET Conference on Computers and Work, op. cit.

23/ Nora Minc - "L'Informatisation de la société", document contributif, No. 1, Documentation Française, 1978.

/...

a 30 per cent reduction in employment in banks and insurance over 10 years. Another French study 24/ estimates that a potential 82,000 out of 349,000 typists in France can lose their jobs as a result of the introduction of word processors. In the United Kingdom, trade union authors have forecast unemployment rates of 20 per cent by the 1990s on the basis of assumptions of labour displacement of 30 per cent in the "information sector" and 10 per cent in the non-information sector. 25/

70. Despite short-comings, quantitative predictions do serve to give an indication of the sensitivity of employment in the tertiary sector to productivity changes, especially if coupled with a slow growth in output. There are, however, reports questioning the probability that these predictions actually will materialize. They particularly point out that the predictions ignore the probable rise in the demand for output of information.

71. According to studies made by the United States Bureau of Labor Statistics the dominant trend in the American economy during the 1980s will be the continued growth of white collar employment. By 1985, the fastest growing occupational group will be that of managers, officials and proprietors, increasing 51 per cent between 1970-1985. The second fastest growing group will be that of clerical occupations, followed by that of professional and technical and then service jobs. 26/

72. The British Department of Employment Study Group 27/ points to the considerable potential for introducing more equipment into offices, but concludes that comprehensive "electronic office" systems are still some way in the future. A number of cross-sector studies indicate that the theoretical productivity gains and large-scale job displacement, predicted to result from the introduction of, for instance, word processors, are not often realized in practice. Where job displacement occurs, the displaced staff are usually absorbed elsewhere, often by growth in new and existing services. The Study Group came across no instances of job displacement arising from the introduction of word processors.

73. The Study Group further points out that a lot of typing employment is generated by small organizations employing only one or two typists. The cost of word processors would, they claim, have to fall very dramatically before such organizations find it worth-while to invest in them. Even then an organization employing two typists will probably find it risky to get by with one. The Group also underlines that most firms have purchased word processors because of a lack of typists - not the other way around. Finally, it is argued that most firms use increased capacity to do the job more thoroughly - instead of doing it faster or more cheaply. The fact that computers have made possible work that previously has been impractical because it would have been too costly or too time-consuming with pre-computer technology, is also mentioned.

24/ Lorenzi and others, "L'électronisation de la société", Université Paris-Dauphine, October 1979.

25/ Sherman Jenkins, "The collapse of work", Eyre Methuen, 1979.

26/ Jerome Mark, United States Bureau of Labor Statistics, "Measuring the effects of technological change", op. cit.

27/ Sleigh and others, The Manpower ..., op. cit.

/...

74. As far as banking and insurance are concerned, the Study Group concludes that the modest increases in over-all employment in banking are likely to continue for at least the next five years and that stability in numbers will be achieved some time between 1985 and 1990. If no new services are developed, some over-all dimunition in banking employment may be expected during the 1990s. Without continued business growth in the insurance industry, over-all numbers employed will decline - perhaps by as much as 15 per cent in the next five years. The Group believes, however, that business will continue to grow.

75. The link between electronic data processing and developments in telecommunications systems has considerable implications for employment, not only in offices but also in the postal, telephone and telegraph services. Predictions in these fields are, however, even more speculative. Services such as electronic mail are still in an experimental stage, although employment effects are expected to be felt in the course of the 1980s.

76. A survey in the Federal Republic of Germany has estimated that 1,920 jobs per year will be lost in the post offices as a result of the introduction of electronic mail and word processing. It will be partially compensated for, however, by the creation of some 1,240 new jobs per year by 1990 in telecommunications services. 28/

77. Over the last five years, employment in telecommunications in Europe has generally increased, although there have been slight decreases in the Federal Republic of Germany and in the United Kingdom. However, there have been structural changes caused by automatic dialing, with large employment cutbacks for telephone operators. In Austria, employment of operators fell between 1973 and 1978 by 25.2 per cent, in Denmark, by 12.6 per cent, in Italy by 16.1 per cent, in the Netherlands, by 6.2 per cent and in the United Kingdom, by 32.3 per cent. 29/

78. In addition to the effects of automatic dialing, the demand for maintenance services will also be drastically reduced. 30/ It should be added however, that the British study group forecasts that employment levels in post offices and telecommunications will remain stable.

79. The past impact of new technologies on employment in the commercial sector has not been easy to discern because it has been closely associated with organizational changes such as the growth of self-service stores and the shift from full-time to part-time employment. Nevertheless, significant employment reductions have taken place in a number of Western European countries. These reductions were partly caused by the introduction of new technology.

80. In the Federal Republic of Germany, employment in retailing fell by 5.9 per cent between 1972 and 1977. In Italy between 1975 and 1976, a loss of

---

28/ The Impact of Microelectronics on Employment in Western Europe in the 1980's, op. cit.

29/ Ibid.

30/ Ibid.

/...

jobs equivalent to 12.5 per cent of total retail employment took place, and in Belgium, retail employment fell by 2.7 per cent over the same period. 31/

81. Point-of-sale (POS) terminals are becoming increasingly common in large stores and supermarkets. It is estimated that in Japan, there are up to 1,600 fully automated warehouses compared with around 80 in Britain and 300 in West Germany. Experiences differ. Whereas POS systems allegedly have brought about staff reduction of up to 20 per cent in the stores themselves in the United States, they have had little impact upon staff members in the United Kingdom. Staff reductions are there considered more likely in clerical functions backing up retailing operations, by introducing computerized ordering and invoicing and automatic stock taking. 32/

IV. Impact on women's employment opportunities

82. As shown in the previous two chapters, the impact of recent developments in microelectronics will be far-reaching - even if the ultimate effect will not be less employment opportunities generally. The range of application is such that the new technology is likely to affect almost every industry and occupation. However, the rate of diffusion and the ultimate level of adoption of microelectronics will vary significantly among industries and occupational categories.

83. With this fact in mind, a particularly important question is whether certain groups in the work force are disproportionately concentrated in the categories most likely to be affected by microelectronics. If so, they are also likely to be disproportionately exposed to the employment difficulties combined with technological change.

A. The labour market - sex-segregated and segmented

84. As documented by a range of studies, the labour market cannot be considered as consisting of one homogeneous group of workers, but rather of various groups with different characteristics, competing in different markets.

85. One of the fundamental characteristics of the labour market in all industrialized countries is the marked degree of segregation by sex: women are concentrated in a limited range of occupations and industries and these occupations and industries are almost always disproportionately "female" occupations and industries. Occupation or industry thus divide the male and female labour force effectively into two different and relatively non-competing labour markets. Hence, labour market segregation has important implications for the incidence of the burden of adjustment to technological change.

31/ Ibid.

32/ Sleigh and others, The Manpower ..., op. cit.

86. Another frequently used distinction is that of the dual labour market: with this approach, the labour market is seen as segmented, with a primary sector employing what are called advantaged workers and a secondary sector employing disadvantaged workers. Disadvantaged workers are employed in enterprises where wages are low, working conditions poor, employment often unstable and opportunities for further on-the-job training limited. They are generally seen as workers with little or no specific skills and with less formal or practical education, such skills as they possess being acquired by doing tasks on the job. In contrast, workers in the primary sector tend to receive higher pay, relatively secure employment and on-the-job training that leads to higher earnings. They tend to have task-general skills, characterized by the ability to acquire specific skills through a process of learning, thereby being able to cope with tasks not encountered before. 33/

87. A great many of the "female" occupations referred to above are in the so-called secondary sector. Therefore, as it is argued that technological change shifts the demand for labour away from those workers with little skills and education and eventually increases their unemployment rates, 34/ this is still another reason for maintaining that women may be adversely affected by microelectronics.

B. The female labour market - likely to the disproportionately affected

88. Analyses of whether the burden of displacement is likely to be borne disproportionately by any groups in society, are rare to find in the literature reviewed. Nevertheless, there seems to be general agreement that women workers are the ones to bear the brunt of the impact. The fact is normally not discussed in detail, but rather stated in one paragraph as the following quotations will show. Often women are mentioned along with other groups such as the elderly and the young - which is most often the case when female employment is referred to as a problem, but not really analysed:

> "The Study Group is fully aware that new technology will have other more specific implications - for example, for school leaves, female workers, part-time working, and in the regions - which are not, in most cases, considered in detail. That is not because the Study Group believes these implications are unimportant, but rather that they require further study." 35/

> "In the absence of full employment, however, rapid and thoughtless technological change can only exacerbate social problems, especially through the displacement of workers - particularly minorities and women who are just beginning to achieve job levels which permit them to enjoy the benefits of technology." 36/

33/ Professor C. P. Harris, "Technology or people".

34/ Ibid.

35/ Sleigh and others, The Manpower ..., op. cit.

36/ Thomas R. Donahue, AFL-CIO "The challenge of technology", op. cit.

/...

"There does seem to be some agreement (in the reviewed literature) on job destruction in specific segments of the labour market: these are thought to be more severe for older workers who have less flexibility in retraining, re-education and relocation and for the lower-level, skilled labour force. Among managers, the middle management is expected to be hardest hit. But overall, it is women, who form the bulk of information manipulators in the service sector, who are expected to bear the brunt of the impact." 37/

89. The basis for the argument that women will be disproportionately affected by development in microelectronics is found in the fact referred to in chapters 2 and 3, that the service sector is likely to be the most affected sector. A higher proportion of women is employed in the tertiary sector than in any other sector. The position in selected EEC countries, for instance, is as follows:

	Proportion of economically active females in the manufacturing sector	Proportion of economically active females in the service sector
France	22.2	34.6
German Federal Republic	28.8	29.5
Italy	24.4	27.6
Netherlands	15.6	38.5
Spain	24.2	30.7
Sweden	15.1	56.4
United Kingdom	22.0	46.3
United States of America	17.0	45.4

Source: 1978 ILO Yearbook of Labour Statistics (Geneva: International Labour Office, 1978) and Elise Boulding and others, Handbook of International Data on Women (New York, John Wiley and Sons, 1976).

90. In the tertiary sector, the clerical sector is of striking importance to women. In terms of numbers alone, the microelectronic revolution should be of concern to women, as estimates suggest that clerical employment is most likely to be affected by the application of the new technology in the tertiary sector:

(a) In the United States, women are 78.7 per cent of all clerical workers and over 95 per cent of all typists and secretaries. As the largest single occupation available to women, clerical work contains a diverse group: 36.4 per cent of all white women working, 30.8 per cent of all Hispanic women working and 24.4 per cent

37/ "The impact of computer/communications on employment in Canada: an overview of current OECD debates", op. cit.

/...

of all black women working. Of all employed married women, 34.1 per cent work in offices, and of all working women over 35 years of age, 30.3 per cent find employment in offices. 38/

(b) In 1976, over 1 1/4 million Canadian women were employed in clerical occupations, more than 25 per cent of all women in the labour force. Of all people employed in clerical jobs, 75 per cent are women. Similar figures could be quoted for most of the industrialized countries.

91. A better understanding of the potential threat to female employment opportunities would demand comparison between industries/occupations in which women workers are actually employed and industries/occupations most likely to be affected by microelectronics. No such thorough over-all studies are available, except an analysis of the Australian work force. 39/ The conclusion of this study stresses that women have reason to be concerned.

92. Selby-Smith first shows the extent of occupational segregation in the Australian labour market: 85 per cent of women in the paid work force were concentrated in 18 of the 61 occupations listed by the Statistician, these occupations being overwhelmingly "female" occupations. In fact, over half of the female work force was concentrated in five occupations as clerical workers: sales assistants, stenographers and typists, housekeepers, cooks and maids and teachers. Thirty-nine occupations were defined as being "male" occupations. Unlike the female work force, the male work force was comparatively widely distributed across occupation groups.

93. Among the "female" occupations, the following were considered as being jobs wherein workers perform tasks which could alternatively be accomplished economically by microelectronic means: bookkeepers and cashiers, stenographers and typists, other clerical workers, sales assistants, telegraphic and telecommunication workers and possibly packers, wrappers and labellers. Selby-Smith found that in 1977, over 50 per cent of the female work force was employed in these occupations.

94. For men, the following occupations were selected: draftsmen and technicians, salesmen, commercial travellers, toolmakers, metal machinists, electricians, electrical and electronical workers, metal workers, compositors, printing machinists, engravers, storemen and freight handlers and possibly labourers. Selby-Smith concludes that a greater number of "male" than "female" occupations will feel a significant impact from microelectronics. However, because the male work force is so widely distributed across a comparatively large number of categories, this results in a considerably smaller proportion of active men working in "at risk" occupations - in 1977, the number was 25 per cent of the males.

38/ Phyllis Marynick Palmer and Sharon Lee Grant, The Status of Clerical Workers, Women's Studies Program, George Washington University, 1979.

39/ Joy Selby-Smith, "Impliçations of development in microelectronic technology on women in the paid workforce", Faculty of Economics, Australian National University, Canberra, September 1979.

/...

95. Selby-Smith emphasizes that "what is not being said is that the existing jobs of all of 50 per cent of women in the workforce and 25 per cent of men are being threatened by microelectronics technology. Rather it is being suggested that, on the basis of the available evidence, microelectronics technology will significantly displace jobs in certain occupation groups in which presently 50 per cent of the female workforce and 25 per cent of the male workforce are employed, and insofar as this occurs the burden of adjustment to microelectronics technology will fall disproportionately heavily on women". 40/

96. The development is not only a threat to women in the workforce. The difficulties may be even greater for the newcomers - both adults wanting to re-enter the labour force and youth entering the labour market for the first time. It is a well-known fact that the tertiary sector and especially the clerical sector, have absorbed most of the rising female labour force participation in the 1960s and 1970s. 41/ The movement of women into non-traditional jobs has so far been statistically insignificant. As jobs disappear in areas where they have traditionally been employed, women are forced into harder competition with each other for those jobs remaining. It must also be kept in mind that many of the jobs which are disappearing are the low skill ones that have offered re-entry possibilities for adults.

97. The future prospects for young women also seem discouraging if nothing is done to change the sex stereotyping in occupational choice. The following examples are cause for alarm:

(a) While 30 per cent of all employed women in Australia are currently engaged in sales and clerical work, 50 per cent of all young girls registered for employment are seeking jobs in these areas; 42/

(b) Fifty per cent of the girls in short vocational training in France are being trained in shorthand, typing and accounting. 43/

C. Additional problems for women

98. If women are disproportionately adversely affected by the new technology, it is also important to bring to the attention of politicians, employers, fellow

---

40/ Ibid.

41/ See for instance, "Review and evaluation of progress achieved in the implementation of the World Plan of Action", Employment, World Conference of the United Nations Decade for Women, Copenhagen, Denmark, 14-30 July 1980, A/CONF.94/8.

42/ "Technological change in Australia - areas of special relevance to women", paper presented by United Nations Association for Australia for submission to the Inquiry into Technological Change in Australia.

43/ L'informatisation du secteur tertiaire.

/...

workers and trade-unionists that women have special difficulties in adjusting to the inevitable changes that must follow. 44/

99. First, the major difficulty derives from the basis of occupational segregation, namely, that for a number of reasons, women have been confined to a limited range of occupations. Therefore, women when seeing these occupations abolished, are left with rather narrow prospects for employment.

100. Moreover, as women - at least older women - often lack extended formal education, they may have greater difficulties in readjusting to new jobs. Because of their position in the so-called secondary sector as referred to above, they may also lack task-general skills which would make it easier to cope with new tasks. Finally, given women's present occupational choices, the technical interest and skills associated with some of the new jobs created may discourage women from applying for them. This is not to say that female occupational segregation cannot be changed. This transition, however, will not come automatically.

101. Second, because of their child care responsibilities, many married women still have disrupted working careers. Thus, they have not experienced the same benefits from a broad on-the-job training and job socialization as the male workers and may be left with narrow task-specific skills, hampering them in the job search process.

102. Third, women's greater family responsibilities obviously make them less geographically mobile in the labour market, thus restricting their employment opportunities.

103. Finally, as pointed out by Selby-Smith among others, women still remain comparatively poorly organized industrially. Women are, therefore, not only in a weak position to argue for appropriate adjustment policies for their particular difficulties on the labour market, they are in a comparatively weak position to bargain for their share in the gains from technological change.

104. Moreover, in times of depressed economic activity, women can become scapegoats for a high level of unemployment. Unemployment, with heightened competition among workers for jobs, has historically tended to act against the right of women, particularly married women, to paid employment. As a result, politicians may often be reluctant to implement policies specifically to assist them in overcoming their particular set of adjustment problems. 45/

D. Possibilities opened by technological change

105. Microelectronics developments, however, do not only represent a threat but also a challenge and a hope. There are several ways in which new technology may be of assistance to women.

44/ Women's special adjustment problems are associated with the unequal sexual division of labour in societies, women being responsible for work at home in addition to their work on the paid labour market. The causes for this division of labour will not be discussed here, as they are the subject of much literature. The implications will also only be referred to, assuming that detailed opinions are already well known.

45/ Selby-Smith, "Implications of development ...", op. cit.

106. First, it may be a way of getting around the frequently used "man's superior physical strength" argument for discriminating against women. Electronic devices - installed rather inexpensively - can help control heavy machinery. This may be the case not only in manufacturing industries but also in farming where automation and ease of handling farm equipment should enable women to become farmers more easily.

107. Second, the growing information sector made possible by microelectronics, may open up a range of new career opportunities for women.

108. Third, computing could be seen as an industry where there is more equality because it does not rely on physical strength but more on mental ability. Besides, it is a "new" industry without deep-rooted sex stereotypes, leaving women the possibility of starting their own businesses as contract programmers, analysts, consultants and the like.

109. It must be added however, that this possibility of unbiased sexual division of labour may already have been lost, and the same struggle to do away with prejudices is needed there, as everywhere else in the labour market. As of 1975 in Sweden, 90 per cent of the employees concerned with electronic data processing management, system-work and programme work were men, 80 per cent were men in the areas of planning, management and contact work as well as in the areas of data processing. The third area, that of punching and data registration, was dominated by women, accounting for 97 per cent of total employment. This work is, no doubt, the less skilled and lowest paid. 46/

110. Fourth, microelectronics technology has the potential of opening up new options for location of industry and employment. While data-processing work until now has had a tendency to lead to large concentrations of central data divisions, it is now technologically feasible and frequently profitable economically to decentralize the processing. Companies and organizations will thus have a greater flexibility in allocating work to different locations, thus creating new employment opportunities in areas with unemployment problems. Microelectronics may, therefore, if used in such a way, improve women's access to work in sparsely populated areas, although as stated above, often in the lowest paid jobs.

111. A final argument used to show the new opportunities associated with microelectronics may prove to be a mixed blessing. The new technology will make it possible for people in clerical, professional and managerial occupations to work from home at least part of the week. There are certainly desirable effects associated with such a development, in terms of less commuting, less alienation between family and working life, a more neighbourhood-integrated life style and greater possibilities for parents - fathers as well as mothers - to combine paid work and family responsibilities. It may make it possible for women to work who would otherwise not have been able to do it. There are, however, also great inherent dangers in such a development, which may adversely affect women in particular, if there are no counter-efforts. The greater freedom to work at home may increase the number of workers suffering the isolation and low pay of existing home workers. With the existing division of labour at home, the probability that these workers will be women, is great.

46/ Socialdemokraterna, Datorer pa manniskans villkor, Program for datapolitiken (The Social-Democratic Party's action program on computer on human terms).

/...

V. Impact on working conditions

112. Microelectronics will not only affect the number of jobs and thus a society's possibilities for leading a policy of full employment, but will have a great potential impact on work organization, content and conditions.

113. As views on employment opportunities differ, so do opinions vary about the new technology's impact on work environment. There seems to be, however, some agreement on potential positive and negative development factors associated with technological change, but there are divergent views about which of these tendencies will be dominant.

114. Again, it is important to emphasize that the final results are not inevitable. Technology has no logic of its own and does not develop from stage to stage in a naturally dictated order, uninfluenced by human values. The eventual impact on work environment results from the way technology is introduced and applied and whose interest it is designed to serve. Therefore, it is of fundamental importance that women engage both in the debate and in the actual process of introducing new technology.

A. Impact on work environments

115. There seems to be a broad agreement that microelectronics in many ways has had a positive effect on work environments. The possibilities of eliminating work that is physically and mentally wearing or tasks that are carried out in unhealthy, dangerous environments have increased immensely, especially in the manufacturing industries. In the process industry, for example, many production processes have been enclosed and partly or fully automated, leaving fewer dangerous, heavy operations. More sensitive and reliable control devices have the potential of reducing health hazards in processes involving dangerous chemicals.

116. At the same time, however, the use of computers and data systems have also led to new work environment problems. While physical work environment risks have been reduced, the result has sometimes meant increased mental stress and anxiety. One example is the increased individual work which is part of new supervisory tasks, leaving people isolated for hours at a time in a control room. Another example is computer terminal work which can be mentally stressful with monotony in some cases and demands for continuous alertness in others.

117. As far as office work - women's present most important work place - is concerned, the new technology may not only lead to new mental strains, but may also create physical health risks. The following problems are often cited:

(a) chronic back pains and permanent injury resulting from long unrelieved periods of sitting at a machine, frequently in an incorrectly designed chair;

(b) painful swelling of the hands and wrists, caused by quick, repetitive hand and arm movements over a long period of time, such as are needed for key punch operations on data entry keyboards, bank cheque processing machines, etc.

/...

(c) headaches, eye strain and permanent eye damage caused by use of video display units;

(d) headaches and partial hearing loss resulting from the increased noise level from electronic machines in open space offices. 47/

More attention should be paid to the use of computer equipment and the ergonomic factors associated with their positioning. The effects of visual display units are particularly important because of the possibilities of exposure to electromagnetic radiation. Thus far, research has found no evidence of such radiation, but continuous complaints about headaches and other ailments by employees have prompted trade unions to ask for further investigations. 48/

B. Impact on work content and skill

118. Probably one of the most direct effects of the more widespread use of microelectronics in manufacturing processes and services will be on the balance of skills. Opinions differ as to what the result will be.

119. Some argue that the new technology will mean an upgrading of skills:

> "Several new skills are going to be required, and on the whole they will be higher level skills than those required at present. Furthermore, there are already shortages of many traditional skills and there is a distinct danger that there will be serious shortages of new skills, especially on the testing and maintenance side. In short, the major effect of widespread application of new technology is likely to be that workforces become more highly specialized and less susceptible to easy substitution and replacement than they are at present." 49/

> "The occupational structure of the nation's workforce is being upgraded. Skilled technical and professional jobs are increasing at a proportionately greater rate. Employers are putting more emphasis on formal knowledge, precision and perceptual attitudes. Many menial tasks are being taken over by machinery with unskilled manual workers increasingly becoming monitors of very expensive equipment." 50/

47/ "Women and technological change", submission to the Committee of Inquiry into Technological Change in Australia from the Working Women's Centre, ACSPA.

48/ Dagbladet (Norwegian newspaper) 17 March 1980. Office Technology: The Trade Union Response, first report of the APEX (Association of Professional, Executive, Clerical and Computer Staff), Word Processing Working Party.

49/ Sleigh and others, The Manpower ..., op. cit.

50/ Mark, "Measuring the effects of technological change", op. cit.

/...

120. More often, however, it is argued that new technology leads to a fragmentation of work and a reduction of the range of skills needed.

121. It is pointed out that complex computer technology makes it possible to break down the job of each worker to its smallest components, each of which can then be re-allocated to a separate worker. Even though automation mainly will affect so-called unskilled workers, there will be a deskilling effect on the labour force, it is argued. It is pointed out that in the past there has been an element of human judgement which gave the operator some degree of independence in her work even in unskilled occupations. The new technology available, however, incorporates sophisticated control devices which eliminate the use of judgement and skill totally.

122. In addition, many jobs which once required a great deal of professional knowledge and training are reduced to what might be termed push-button jobs. Clerical work is a typical example: while typing and shorthand take time to perfect and develop speed facility, the word processor requires only familiarity with a keyboard. A qualified typist could learn in three or four days, the entire complex of operations which a word processor can perform. An unqualified typist could learn the most basic procedures in only half a day. 51/ A less experienced typist is able to produce the same quality of work as a skilled typist and almost as quickly, it is claimed. 52/

123. It must be added that the degree of training needed to operate a word processor varies greatly. The British Association of Professional, Executive, Clerical and Computer Staff (APEX) claims that the basic functions of a stand alone system can be learned in a few days, while more sophisticated shared facility systems require longer formal training and experience of three to six months. 53/ Others stress that skilled use of a word processor is more a function of clever use of the built-in facilities than of typing speed. Thus, productivity depends more on mental agility than on manual dexterity.

124. Filing clerks will not only be greatly reduced in numbers, but will have their functions changed as well. There may still be a filing role, but it would consist only of keeping in the appropriate file number and the date of each item for entry, and the computer would do the rest. Again it must be added, however, that filing is not just input but retrieval as well. The skilled electronic filing clerk is one who uses retrieval functions cleverly.

125. As divergent as these views may appear to be, they indicate that application of the new technology is likely to bring about a more polarized division of labour, with women at the bottom of the new hierarchy. Computerization tends to produce a

---

51/ Jane Barker and Hazel Downing, "Office automation word processing and the transformation of patriarchal relations".

52/ Ibid.

53/ Office Technology: The Trade Union Response, op. cit.

/...

strictly segmented work force, a large group of basically unskilled operators with little mobility and a small, elite, highly paid group of tertiary-educated professionals.

126. For instance, it is pointed out that in the office sector, job fragmentation which accompanies computerization, means a greater separation of administrative duties from routine tasks such as typing, filing and copying. While the latter tasks are performed by operators using word processors, the more highly competent secretaries may be freed from these routine tasks and then be in a position to provide fuller assistance to senior executives and professionals in carrying out their duties. Hence, it is claimed, not all typists/secretaries will be adversely affected by word processing. The confident, experienced typist/secretaries will have widened career paths opened to them.

127. The important question is, what are the relationships between the two tendencies: are more workers seeing their work downgraded while only a few profit from greater possibilities? How are women able to exploit the new career possibilities?

128. Another important factor to be added is that the introduction of technology need not be organized in such a way that it deskills jobs and reduces the opportunity for learning and promotional advances. Again, it is a question of how it is applied and what goals it is designed to attain. The technology may be applied to do away with tedious parts of the workers' tasks while still leaving the primary judgemental decisions to the workers. Trade unions' claim for greater workers' participation in the introduction of new technology is based on an understanding of this fact. Therefore, the active participation of women workers in controlling the application of technology is important if they are to safeguard their positions on the labour market.

129. Fragmentation of work and reduction of skill requirements may also have a damaging impact on job security. As the jobs are relatively simple and the machines set the pace, there is little advantage to employers in encouraging a stable work force. Therefore, it is claimed, workers can more easily be moved in and out of the work force, depending on particular short-term labour requirements.

130. This tendency, if true, could be most damaging to women, reinforcing the weaker commitment to the labour market they often have as a result of greater family responsibilities.

131. This chapter is not meant to be a complete overview of the impact of microelectronics on working conditions. Huge and important fields such as the impact on monitoring of the work process are, for instance, left out.

132. What we have tried to do, is to point out certain problem areas linked with technological change. Although the new technology opens up possibilities for improving working conditions, negative development trends are possible, if not counteracted. Women workers should participate in the process of steering the development in a direction which benefits their interests.

/...

VI. Future courses of action

133. As stressed above, the impact of microelectronics is not determined by pre-arranged design or unknown forces. The course of events is determined by how the new technology is introduced and applied, what aims and goals it is going to serve and whose values are going to gear the development.

134. The process of change is already there; decisions are taken every day - deliberately or not - which influence the process. The fundamental issue at stake is whether the over-all benefits which accrue from technological change will be equitably distributed among all the members of society. Another crucial question is whether the adjustment problems which are bound to arise are allowed to strike one group disproportionately and whether an efficient policy is established to meet the problems.

135. It is important that women take part in the ongoing public debate, in the many studies currently being prepared and in the decision-making bodies concerned with technological change. In this report, we have provided some examples which may serve to illustrate where women might channel their attention and influence.

A. Women's participation in public debate and decision-making

136. A series of studies, often government-supported, are currently under way in the industrialized countries. They are partly prepared by independent research bodies, partly by government committees, working groups, etc., and are being handled as follows:

(a) In France, the problems were dealt with at the request of the President of the Republic, in a report prepared by Simon Nora and Alain Mincs. In autumn 1979, the French Ministry of Industry held a great public debate "Semain Informatique et Société". A whitepaper is prepared on the basis of the discussion.

(b) In the United Kingdom, the Central Policy Review Staff is co-ordinating studies on the social and employment effects of microelectronics. A Department of Employment Study Group published a report on manpower implications of microelectronic technology in December 1979. That department is now considering what further action is required by the recommendations in the report. 54/

(c) In the Federal Republic of Germany, the Ministry of Research and Technology is conducting specific projects on humanization research, information technology and microelectronics. The impact of new technologies on gainful employment of women is said to be a major subject of the technology dialogue in Germany in 1980. 55/

54/ Department of Employment, Press Notice, 19 December 1979.

55/ Letter to the secretariat of WCUNDW from the Permanent Mission of the Federal Republic of Germany to the United Nations, 14 March 1980.

/...

(d) The Swedish Government has set up two commissions, one to study the effects of data-processing technology and electronics on administration, production and productivity in different branches of the economy; the other to study the consequences for employment and the working environment.

(e) In Norway, the Ministry of Labour and Local Affairs has appointed a task force to look into the effects of economic and technological development on working conditions and employment. Several government-supported research projects are being carried out.

137. In Canada, the Department of Communications has a programme of study under way to examine the broad social and economic impacts of information technology on society. 56/ The Canada Employment and Immigration Commission has recently developed a series of occupational analyses on the information sector. They are in the process of sponsoring a policy committee to study the impact and propose actions relative to the microelectronics revolution both within the operations of the Commission itself and in the labour market as a whole. 57/

138. In late 1978, the Commonwealth Government of Australia set up an independent committee to examine, report and make recommendations on the process of technological change in Australian industry.

139. No systematic analysis has been made of the mandates of the different commissions and groups or of the reports resulting from their work to find out whether questions concerned with the impact of technology on women have been dealt with adequately. Nor has the composition of groups been analysed. The impression left after going through the literature is, however, that special problems confronting women are neither recognized nor analysed, although several reports have a few paragraphs stating that women as a group - along with the elderly and the young - are likely to bear the brunt of the technological change.

140. The Australian case seems to be an exception. The Committee is reportedly aware of the fact that technological change particularly affects women. 58/ The vulnerability of women has not, however, emerged as a major concern in the Inquiry. 59/ Nevertheless, several papers discussing women's problems in

---

56/ Letter from Government of Canada, Department of Communications, 8 January 1980 to the WCUNDW secretariat.

57/ Letter from Employment and Immigration Canada, 25 January 1980.

58/ "Comments on the impact of technological change", presentation by the National Women's Advisory Council to the Inquiry into Technological Change in Australia.

59/ Letter of 11 March 1980 from CAGEO (Council of Australian Government Employee Organizations) to the WCUNDW secretariat, submission of Women's Union Committee (ACT), submission of South Australian Working Party on Women and Technological Change.

/...

particular, have been submitted to the Committee - some of them by women's organizations. 60/

141. The material collected for this report does not contain data that shows to which extent women's organizations in other countries have engaged in the current debate on microelectronics. The point we would like to make, however, is that there are many studies now under way in which women and women's organizations should take part.

B. Women's participation in trade union debate and decision-making

142. Trade unions have, in many countries, initiated the debate on microelectronics and may play an essential role in the introduction of new technology. Women should take an active part in elaborating the trade unions' policy on technological change.

143. Generally, the trade union response has been that a policy of opposition is not viable and would only prove harmful to the workers in the long run. Unions have claimed, however, that a central requirement for a satisfactory solution of the problems associated with new technology is that they should be involved at the earliest opportunity at all levels of policy-making: the enterprise, company or industry level and at the national and the international levels. 61/

144. The appropriate bargaining level will depend on the collective bargaining structure of a particular country or sector. In some countries, normal collective bargaining structures are the channels through which technological change is negotiated. This is where women should participate.

145. In other countries, special organizational procedures and agreements exist. In Norway, a data agreement was first signed between the employers confederation (NAF) and the trade union federation (LO) in 1975 and revised in 1977.

146. The agreement grants the union right to:

(a) be informed about plans for new data systems as early as possible.

(b) participate in system design.

(c) appoint a new representative, the data shop steward, with special responsibility for this area.

60/ Ibid. Additional briefing notes from the Women's Health Unit, Department of Health. "Technological change in Australia - areas of special relevance to women", paper presented by United Nations Association of Australia; submission of the New South Wales Women's Advisory Council.

61/ This paragraph is primarily based on The Impact of Microelectronics on Employment in Western Europe in the 1980s, op. cit.

/...

(d) receive relevant education and enough time to do the job during regular working hours, both for the data shop steward and for other union representatives participating in project work.

147. In the United Kingdom, the Trade Union Congress (TUC) has proposed that trade unions should consider the possibility of new technology agreements and has issued a set of guide-lines for negotiation. A series of collective agreements has already been finalized covering the introduction of new technology. Such agreements covering technological issues are already in effect in some sectors in other countries as well. Where agreements exist, workers have a means to influence the way technology is introduced and applied. Women workers should see to it that they use this channel.

148. Trade unions have seen the proposed level of employment as one of the central issues to be negotiated when new technology is proposed. One response of the trade unions has been to negotiate "no redundancy" agreements, which normally involve internal redeployment of staff. It is important to ensure that the interests of female workers are taken properly into consideration in such a process.

149. The European Trade Union Institute has pointed out that "no redundancy agreements" on their own are a defensive strategy and may simply protect the employed work force at the expense of newcomers on the labour market, such as young people. It claims, therefore, that a further issue for discussion should be the level of output associated with the introduction of new techniques. Although the general economic situation will be of vital importance for the decisions made, the trade unions should question what new products or services the enterprise is developing to offset job losses. 62/

150. Women, knowing that female workers constitute a greater part of the newcomers, should involve themselves in such discussions.

151. Trade unions have also stressed the importance of negotiating issues concerning the quality of working life and health and safety factors, cfr. chapter 5 above.

152. It should be kept in mind that women predominate in work areas where health hazards are likely to produce symptoms not readily and currently accepted as industry-induced, such as eye strain and headaches. Trade unions must be persuaded to treat women's work risks as seriously as those encountered by men.

153. In addition, comprehensive studies of potential health risks need to be undertaken.

154. As was the case with government bodies, no systematic analysis has been made of the trade unions' concern with the technological impact on female workers. Again, our impression is that very little attention has been paid to the question.

62/ Ibid.

/...

155. The International Federation of Commercial, Clerical and Technical Employees (FIET) had a conference on computer and work in 1978. The organization's report may illustrate the situation. 63/ Although FIET stated that "the deepest impact of current developments in computer technology is likely to be on the sectors in which FIET's members work: banking, insurance, commerce and white collar jobs in industry", only one reference was made to the fact that women would probably be the most strongly affected.

156. The Swedish trade union federation, LO, admits that it presently lacks specific knowledge about women and employment consequences, but adds that the questions are being considered during preparation for the LO Congress in 1981. 64/

157. The British Trade Union Congress states that it "has long been concerned to break down the barriers which have effectively limited women's choice of employment. The advent of microelectronic technology on a large scale makes it even more urgent and necessary that through reforms, particularly in our education and training systems, we equip women with the skills to break into employment across the whole range of occupations." 65/

C. Policy measures

158. As shown in chapter 4, women as a group are likely to be disproportionately affected by microelectronics. Governments must, therefore, be asked to pass compensatory measures to help women overcome the difficulties. Educational and labour market policy measures are of special importance.

159. Women's narrow occupational range has been shown to make them particularly vulnerable, partly because the traditionally female occupations are most likely to be affected and partly because women have fewer alternatives to choose from. The fact that women traditionally have occupied the low skill, low pay, low status jobs increases the problem. With automation, a number of these unskilled jobs will be gone.

160. There is still much uncertainty about what kind of new jobs will be created, but some development trends are clear. Engineers, technicians, programmers, analysts, computer operators as well as system designers will be needed. Lack of software skills is already a bottleneck in the application of microelectronics, and the demand will probably increase.

161. What is important here is the fact that these occupations traditionally employ an insignificant number of women. With these prospects in mind, it should

---

63/ FIET Conference On Computers and Work, Velm, Austria, 17-18 November 1978.

64/ Letter to the Secretariat of the United Nations World Conference for the Decade of Women.

65/ Employment and Technology, A TUC Interim Report, op. cit.

/...

be more important than ever to eliminate labour market segregation, broaden women's occupational choices and make them enter new "non-traditional" fields. Experience has shown that such a change is not brought about overnight, because the existing role pattern is based not only on century-long attitudes and expectations, but on an actual division of labour within and outside of the home that leaves women with fewer options on the labour market. It is not enough to ensure boys and girls, men and women, the same formal opportunities in schools and jobs. Much more active, systematic efforts are needed in occupational counselling, in curriculum choices and teaching in schools and in the use of media, just to mention a few possibilities. 66/ Facing a potential cutback on female employment opportunities, Government should also be willing to consider more far-reaching measures such as quota systems and affirmative action programmes as well as measures which motivate and enable men to take their share of the work at home.

162. The importance of influencing the young generation can hardly be stressed enough. Girls' technical literacy and abilities must be developed and strengthened through attitude change and positive discrimination measures in educational and vocational areas. The educational system is the vehicle of ridding girls of the idea that technical work is unfeminine.

163. For women already in the work force threatened with displacement, adequate retraining facilities must be ensured. As part of the sharing of benefits from technological change, the cost of such retraining should be borne by the employer and/or the Government. Any retraining programmes must take into account the generally lower educational qualifications and limited work experience of those women most likely to be displaced. Flexibility of entrance to courses and positive encouragement for women to consider non-traditional female occupations must be provided. In addition, the practical arrangements of courses must, in the short run, take into consideration that a lot of women have to combine work/training with unpaid work at home and, in the longer run, move towards desegregating unpaid work at home.

164. Changing educational and occupational choices, retraining programmes and adaptation to new skills are all options based on the assumption that an adequate number of jobs exist.

165. Faced with the possibility that technological change will lead to an over-all contraction of employment opportunities, many spokesmen, especially trade union leaders, have advocated a reduction in standard working hours as a means of addressing the problem. Shortening working hours is seen as a way of redistributing work from the employed to the unemployed. The reduction in hours could be achieved without any reduction in community living standards, given that productivity will improve through computerization, it is claimed. Society's new

---

66/ Educational and occupational choices and the resulting segregation of the labour market is analysed in most papers concerning women's employment opportunities. Measures to eliminate the segregation are also discussed elsewhere and will not be repeated here. See among others: 'Review and evaluation of progress achieved in the implementation of the World Plan of Action (WCUNDW, A/CONF.94/8).

/...

wealth will provide the wages for the extra workers needed because the work force is working shorter hours.

166. In further discussion, it is very important that women's rights to paid work, whatever their civil status, is fully established and recognized. If job sharing and redistributing of work from the employed to the unemployed is proposed, it is also important that women be included in the term "unemployed" - not only the women displaced from jobs, but also the greater group staying at home because they lack employment opportunities.

167. Job sharing is not only a way of redistributing work. Reduced daily working hours for both men and women is a way of enabling parents with young children to combine paid work with raising children. In practice, this will above all improve women's opportunities on the labour market. From women's point of view, it is an additional reason for arguing that the existing work should be shared. It is also a reason for arguing that reduced working hours should be brought about primarily by shorter daily hours - and not by a reduced working week or longer holidays.

168. This is not to say that job sharing and reduced hours should be used as an alternative to an active economic and labour market policy aimed at achieving full employment.

169. A reduction in working hours is not, however, the only possible outcome opened by technological change. Running counter to this is the pressure to have work carried out seven days a week, 24 hours a day since the technology makes it not just possible but economically very desirable. The latter could mean increased overtime by those already working and pressure towards shift work. Shift work is less desirable for any workers, but particularly so for persons with family responsibilities.

170. It is, therefore, important for women to ensure that opportunities created by new technology are used to bring about future working patterns favourable also to women workers. They should increase, not reduce, employment opportunities, and they should make it easier for workers with family responsibilities - men and women - to combine paid work and care work.

171. Changed working patterns means a redistribution of existing work. An even more challenging task ahead is the creation of new employment opportunities. Most important in this respect is the general economic policy lead. Several spokesmen, however, stress that a positive outcome also is dependent on a massive expansion of service sector jobs. 67/ The French Nora-Minc report is optimistic about overall levels of employment only if the new wealth created by economic growth is channelled back into sectors which are not directly exposed to foreign competition and automation - that is, into community-level social services, such as recreation, health, education and cultural activities, public transit and to a

---

67/ Cfr. chap. 2, para. 5.

/...

lesser extent, housing and tourism. 68/ The British Trade Union Congress states that "it would certainly be wrong to see growth in manufacturing industry and in the public services as alternatives. Greater provision and higher quality of public services will be one important vehicle for distributing across the whole community the wealth and extra resources generated by technological advance and growth in manufacturing industry". 69/

172. Expansion of the public sector is, however, not an undisputed solution. Opinions differ, as to the willingness to transfer a greater share of total expenditure from the private to the public sector with the wealth redistribution effects it implies.

173. Faced with alarm and uncertainty about future employment prospects, Governments should give the employment generating aspects of the public sector increased consideration. Women's interests are not only in the possibility of job creation through such a policy. In addition, the provision of adequate social services improve women's - and men's - possibilities to combine paid work with care work at home.

D. Courses of action - summary

174. The present report has shown that no consensus has been reached on the key question of the total job balance effect of technological change. Nor does the available information allow clear conclusions about the net effects on women's employment opportunities. Counteracting tendencies exist, some of them discouraging, some of them promising.

175. Further analysis on the employment consequences of technological change are needed. They should focus on the impact on groups of workers and job-seekers and not merely on aggregate employment levels. Results should be broken down by sex when relevant. Such studies should be undertaken at the national level, but should also be of concern to international organizations.

176. Whatever the long-run effects of microelectronics may be, the report indicates that adaptational problems will certainly arise. The analysis further suggests that women as a group will be disproportionately affected. Moreover, because of the unequal distribution of labour between the sexes at home, and the sex-segregated labour market, groups of women may have additional difficulties coping with the problems that arise:

(a) Facing the challenges of microelectronics, it is more important than ever that Governments pursue a policy of full employment.

68/ Cited in "The impact of computer/communications on employment in Canada: an overview of current CRTC debates", Institute for Research on Public Policy, op cit.

69/ Employment and Technology, A TUC Interim Report, op. cit.

/...

(b) Governments should also ensure that social costs and benefits associated with technological change are equitably distributed among the population. No single group of workers or jobseekers should have to suffer the ill effects of innovation.

(c) Appropriate measures should be taken to meet adjustment problems. Governments must consider the special difficulties women have in adjusting to the changes.

(d) Women should participate in the current debate and decision-making process about technology and use their influence to ensure a future development which is beneficial both to women and men.

(e) Governments, trade unions, management and others must recognize the necessity of involving women in discussions and take measures to have them participate when decisions are made.

177. As it was emphasized by the Swedish Trade Union President Gunnar Nilsson at the Metal Workers' Union Congress 1977, "What it is all about is the power to decide how computers are used. They can have disastrous effects on the conditions of working life as well as open up numerous new possibilities to a better working environment, increased influence and new jobs".